San Francisco Bay Conservation and Development Commission
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TO: All Engineering Criteria Review Board Members

FROM: Rafael Montes, Senior (Staff) Engineer (415/352-3670; rafael.montes@bcdc.ca.gov)

SUBJECT: **Approved Minutes of August 11, 2015 BCDC Engineering Criteria Review Board Meeting**

1. **Call to Order.** The meeting was called to order by the Chair Dr. Roger Borcherdt at approximately 1:00 p.m., in the Milton Marks Conference Center-Monterey Room, 455 Golden Gate Avenue, San Francisco, California.

The following Board Members were present: Dr. Roger Borcherdt, Board Chair, Professors Jack Moehle (UC Berkeley) and Martin Fischer (Stanford), Mr. Jim French, G.E., Mr. William Holmes, S.E., Dr. Lou Gilpin, C.E.G., who was present for items one and three, and Mr. Richard Dornhelm, who was present for the first two discussion items. The members of the staff present were Mr. Eric Buehmnan, Permit Analyst, Ms. Jaime Michaels, Principal Analyst, Mr. Bob Batha, Chief of Permits, Mr. John Bowers, Staff Counsel, Mr. Brad McCrea, Regulatory Program Director and Mr. Rafael Montes, Staff Engineer and Board Secretary.

The audience included the following people: Mr. Ted Trenkwalder and Ms. Sandy Yee of COWI, Mr. Justin Bajema and Mr. Brian Wilson of Anvil Co., Ms. Chris McDowell and Mr. Dominick Tagalog of Tesoro, Mr. Haze Rodgers and Dr. Ramin Golesorkhi of Langan, Mr. Dilip Trivedi of Moffatt and Nichol, Mr. Jeff Fippin, Mr. Taylor Hall and Mr. Uri Eliahu of ENGEO, Mr. Sam Yao and Mr. Ali Naeem of Simpson Gumpertz & Heger, Mr. Arul Arulmoli of EMI, Mr. Kevin Treat of KPW.

2. **Approval of the Meeting Minutes of May 28, 2015.** Chair Borcherdt solicited comments from the Board members regarding the last Board's meeting minutes of May 28, 2015 with respect to the review of the Treasure Island project in the City of San Francisco, California. There were no comments or changes. Mr. Holmes moved the motion to approve, which was seconded by Mr. French. There was one abstention from Professor Moehle, who had not attended the meeting. The Chair entertained a vote to approve the minutes. They were approved unanimously.

3. **Administrative Matters.** Mr. Batha gave a brief overview of public meeting requirements and emphasized three items when reviewing engineering criteria submitted by applicants: (1) if the Board believes that the criteria is insufficient or not appropriate for the project, it must be very clear to the staff and the applicants in its comments and guidance; (2) be clear in the summary of recommendations at the end of the discussions once a consensus has been reached so the Chair, Mr. Montes and Board members would try to summarize as best as possible the most relevant take-home items; and (3) finally, all of the procedures within BCDC are in light of a public process; therefore, the Board must provide the public with a chance to weigh in on any of the information submitted for review and opinion. Any points of discussion outside of the public meeting should be just points of clarifications and not discussions.

Mr. Batha added that if the Board requires additional information to inform it about the suitability of the criteria, this would be provided as part of the following meeting and the Board would decide that another meeting is needed; BCDC would then schedule a follow-up meeting. These proposed practices are similar to the ones used at the other BCDC board, the Design Review Board, which reviews project for the suitability of public access. Mr. French asked about the role of the Design Review Board or DRB. Mr. Batha explained that it dealt with public access and ways to improve it or enhance it. Mr. Montes pointed out the presence of his counterpart in the DRB, Ms. Ellen Miramontes, who was in the audience.

Mr. Dornhelm requested further clarification regarding email exchanges between Mr. Montes, the Board and among individual Board members.

Mr. Batha responded that all outside communication should be kept to a minimum when related to project reviews, and that if at all, it would be done regarding clarification of statements for the minutes and similar items.

Mr. Montes expanded the clarification to say that communication between the secretary and the ECRB would be for housekeeping items such as filling out of forms (travel reimbursements, yearly statements on declarations of conflict-of-interests, etc.), reminders of meetings, time polls, items that would not involve discussion of projects under Board's review.

Mr. McCrea stepped up to provide further information by saying that although no rules had been violated, BCDC and the Board had been working too close to the margins of the Open Meeting Act, and, therefore, the agency, on the advice of its staff attorney, has decided to do things differently. As a result, BCDC will be discouraging the amount of information that happens outside of the meeting room for everyone's sake and no information would be traded that everyone is not privy to. This way, the new practice would not put BCDC or Mr. Montes in an awkward position as liaison. With this in mind, any recommendations should be made and stated very clearly, and if new information is needed to get a consensus of approval, it would have to come back to the Board for further assessment. BCDC would hold additional meeting to accomplish this.

Mr. Montes also asked the Board to consider the continuance of issues in relation to further meetings. So the Board should weigh whether important issues should be resolved at the meeting at hand or future meetings. Further, he said that the ECRB is not a substitute for formal peer review.

Chair Borcherdt counted that the Board was cognizant of the Open Meeting Act requirements, to the commitment of developing a consensus in the meetings and to ensuring that any correspondence between staff and the Board takes place between all Board members intended as an open forum.

Finally, Mr. Montes noted BCDC would like to develop a calendar of meeting events so that the agency and the applicant seeking a review can expect a timely date to anticipate to meet with the Board. He suggested the last Thursday of every other month as a tentative meeting event. He would survey the Board in this regard. Dr. Gilpin indicated availability on the 1st Thursday every third month. Mr. Batha objected to that date since Commission meetings are usually scheduled for the 1st and 3rd Thursdays of the month. Chair Borcherdt suggested that this endeavor be done via email rather than through a discussion here, and this item would essentially be a housekeeping item not subject to the Open Meeting Act.

4. **Tesoro Martinez Refinery –Avon MOTEMS Compliance Project.** Prior to the presentation there was a round of introduction of the meeting attendees. Mr. Dominick Tagalog was the first person to present himself. He introduced Ms. Chris McDowell, Mr. Dr. Golesorkhi of Langan/Treadwell&Rollo, Mr. Ted Trenkwalder and Ms. Sandy Yee of COWI/Ben C. Gerwick, Mr. Brian Wilson, Mr. Justin Bajema of Anvil. Mr. Erik Buehmann and Ms. Ellen Miramontes of BCDC, Ms. Laure Kovary and Mr. Avinash Nafday, P.E. of State Lands Commission, Ms. Jaime Michaels, the permit analyst that worked on the Tesoro Project. Dr. Gilpin recused himself due to the involvement of his company in the discussions.

As a response to the Board's concerns regarding the pending issues of the pipeline displacement analysis as much discussed since the June 10, 2014 meeting, Mr. Tagalog was ready to present a strategy of how to accomplish the task and was also here to confirm/validate such approach.

First of all, he said the team wanted to utilize the existing information to do the requested new analysis. He showed slides of the new pipeway and the approach trestle. He revisited the project itself and the jurisdictional boundaries of BCDC in relation to the project site. He observed the items that needed to resolve. One item was in regards to the general ground movement and its effects on the anchor stations and how it is incorporated in to the relative movement and its progression into the stress analysis for the piping system. He deferred to Dr. Golesorkhi to explain the geotechnical findings. Dr. Golesorkhi noted that the information had been explained in June 2014 in which the general soil conditions throughout the length of pipeway, about half-a-mile long, were consistent. To corroborate such conclusion, his team had done some more work, not as part of this project but at an adjacent project. Additional 11 cone penetration tests or CPTs for soil testing had been done in 2014 along the alignment of the pipeway for the other project. The results of the information indicated that the soil conditions did not change much along such alignment. Mr. Rodgers said that there had been 2 spectra developed for the offshore structures,

one for the Berth 1A and the approach trestle facilities. In conclusion, the pipeway would experience the same ground shaking and responses from one end to the other. The only difference would be attributed to the lag of time shaking. He then turned over the rest of the presentation to Mr. Trenkwalder of COWI to explain the structural evaluation.

He described the area as having five anchor stations over 24 to 36-inch piles depending on location. P-Y spring (ground shaking) analyses were done at those locations where a displacement demand of the shaking of the ground was gotten. Anvil and COWI worked together to mitigate all ground movement to both structures, the Berth 1A and the pipeway. Both displacements of the structures were kept in the elastic mode where with shaking the structures would be able to return to their original shape. He suggested that the team would get the ground motions again to check and make sure the pipes would not get overstressed. He turned it over to Mr. Justin of Anvil Co. He reiterated Mr. Trenkwalder's approach regarding the displacement analysis between Berth 1A and the maximum pipeway stresses and displacement. The displacement was then assumed at the out-of-phase maximum angles. His results, according to Mr. Justin, showed that the pipeway would be able to withstand significant deflections and movement without the loss of containment as seen in the 2008 allision of some years ago involving a tug boat. Mr. Holmes requested a description of the two displacements mentioned during Mr. Justin's briefing. Mr. Holmes indicated that there had been a force displacement based upon the response of the pipe and a reaction from force acceleration response of the pipe and is that reaction that causes the pipe to move. In other words, Mr. Holmes said that such displacement is not related to the ground motion. Mr. Justin said that seismic motion had been part of the analysis. Mr. Trenkwalder reiterated that seismic response of the ground had been taken into consideration when analyzing the displacement of the pipeway.

Mr. Tagalog reiterated the intention of the team to use the available information to satisfy the new analysis of displacement. Differential ground displacement between adjacent anchor supports are solely due to the time lag effects. Mr. Holmes asked him to reconcile the statements made in relation to the development of the two spectra for the pipeway and the Berth 1A and the resources and information available to do the analysis of displacement of the anchor stations.

After further clarification inquiries, Mr. Tagalog told the Board that the two spectra had been developed one specifically for Berth 1A and the second one for the entire approach trestle (on- and offshore). So the spectra for Anchor Station 1 would be the same as for Anchor Station 2. The latter was located closed to the shoreline while the former was closer to Berth 1A. Both stations were separated by a distance of about 716 feet Mr. Holmes thought that different spectra should be considered for each station. Mr. Rodgers said they would verify and check the conditions for possible spectra development. He suggested significant changes on the slope of the mudline where they would run a check.

Chair Borcherdt suggested that a specific site response analysis at each anchor station should be developed. Dr. Golesorkhi indicated that his team would look at Anchor Station 1 with respect to the rest of the pipeline site-response. As for the Berth 1A, he said his team had developed its own spectra. The chair emphasized the importance of doing the response spectra at Anchor Station 2 at the shoreline in order to develop estimates of the displacements and effects of the ground motion at the two locations as well as along the pipeline. Mr. Holmes wanted to include the development of the spectra at Anchor Station 1 but also the temporal effects along the pipe. Therefore, the item regarding the analysis of differential ground-motion maximum displacement at the anchor supports depend on the time lag effects was amended to be dependent on the results of the information above.

Next item 2 was related to total anchor points relative displacements would be updated to take into account differential ground displacement. There were three bullet points under this item 2. He mentioned the method to be used, Square Root of Sum of Squares or SRSS, to get the maximum relative ground displacement and maximum relative structural displacement to provide a reasonable estimate of maximum (total) relative displacement for pipeline stress analysis. The last bullet of item 2 was about a note about his opinion that the likelihood of maximum relative differential ground motion will occur at the same time as maximum relative structural displacement due to pipeline reactions and seismic inertial load effects. Item 3 was about redoing the pipe stress analysis utilizing the new total relative displacements.

Last point was to reconvene with the ECRB with updated analysis prior to March 1, 2016. There was some discussion about bullet point 3. Mr. Holmes requested clarification of the methodology to use for figuring out maximum displacement in combination with the ground movement effects. Dr. Golesorkhi further explained the device of the maximum movement value demand for the pipes. Mr. Trenkwalder added to the clarification of the methodology to capture the ground movement in relation to each anchor using an iterative process to come up with a maximum movement demand value. Mr. Holmes opined that the thrust of the analysis seemed to provide a conservative displacement result; however, he thought the logic of the approach was a bit amiss since as explained by the team, the support piles may not be affected by most of the ground shaking. Therefore, the analysis should be based on such findings to estimate what ground loads affect the system and then address a solution.

Although Mr. Holmes found the proposed analysis reasonable from the force-approach, meaning piles resisting ground shaking; however, the analysis for the displacement was not so clear. However, Professor Moehle found the applicant's criteria to be adequate, reasonable and acceptable provided there were no permanent movement of the ground that affects the stress of the pipes appreciably. Chair Borcherdt brought back the focus of the discussions today to be intended to provide a path forward to the applicant. He pointed out that the issues revolve around the analysis of the pipe displacement that took into account variations in thickness of ground motion with respect to two anchor points and the impact of soil failure. He deferred to Mr. Holmes to summarize his comments with respect to the proposal put forward by the applicant.

Mr. Holmes indicated that although he had suggested originally the use of the SRSS method to analyze maximum relative ground displacement, he had now questioned that approach based on Professor Moehle's comment that this method was not appropriate or adequate when permanent ground deformation was at work. Therefore, if there were permanent deformation of the ground to influence the pipe structure's supporting piles, an analysis should be done to take that into account. Professor Moehle indicated that Caltrans has methods of analyzing this sort of ground deformation scenarios, if the deformations are not negligible, with respect to piles. Permanent ground deformations would have to be applied to pile supports to figure out how much the piles move the anchor loads. Further discussion on this issue ensued.

Mr. Tagalog replied that soil failure scenarios had not been considered before today's discussions, and that he would have to check with his team of experts to gauge the efforts it would entail. The chair and the rest of the Board thought that a path forward would include the permanent deformations and the time when they would occur. If there was an expectation that the deformation would not be negligible at the same time as the transient motions, it would be wise to find a reasonable way to include that into the analysis. The permanent deformations would most likely happen after the main shake is up. Mr. Tagalog opined that such approach would add to the uncertainties to the path forward. There was some sense of disappointment from the side of the Tesoro team as this new suggested approach by the Board had not been mentioned prior to today. After some back-and-forth discussions on this new approach, it was agreed that the path forward to the project would include this potential permanent deformations in the analysis of the displacement demand of the piping system. Mr. Montes reminded the Board that the Commission under Bay Plan policies has empowered them to revise the engineering criteria if the Board considers it not appropriate. Mr. Holmes expressed that with all the parameters that had been discussed, which included the attention to the soil failures into the displacement modeling there was no need to revise the criteria. Mr. Borcherdt agreed with such approach along with the Board.

5. **Brooklyn Basin Discussion.** Mr. Fippin introduced Mr. Patrick Van Ness of Zarsion Oakland Harbor Partners or ZOHP, Sam Yao and Mr. Ali Naeem of SGH and Dr. Arul Arulmoli of EMI, Mr. Kevin Treat of KPW, Mr. Taylor Hall and Uri Eliahu of ENGEO and Mr. Dilip Trivedi of M&N.

He indicated that the presentation would focus on the comments received by the ECRB and not to discuss the entire project. The comments referred to by Mr. Fippin were provided by the Board on February 26, 2015 and included the following items:

a. Sheet pilings and consideration of future dredging that may affect profile of the bottom of the Bay and impact to the current design. This item would be addressed during the presentation of the geotechnical evaluations-criteria;

b. The specific site response analysis requested by the Board, This item would be addressed during the during the presentation of the geotechnical evaluations-seismicity;

c. Better estimates of fill within the 100-foot shoreline band with respect to the overwater structures. This item would be discussed during presentation of project overview;

d. The amount of fill in the Bay. This item would be discussed during presentation of project overview;

e. Impact on the Bay from potential failures of the sheet pile walls. This item would be addressed during the during the presentation of the geotechnical evaluations-results, active and passive strengths, dynamic seismic increments, and selection of methodology for analysis on sheet pile walls. This item would be addressed during the during the presentation of the geotechnical evaluations;

f. Time of consolidation consideration, including geotechnical evaluation. This item would be addressed during the presentation of the geotechnical evaluation- Clinton Basin Discussion; and

g. Displacement of existing piles outward of the proposed toe wall piles. This item would be addressed during the presentation of the geotechnical evaluation-results.

Mr. Van Ness provided an overview of the project site. The team proponents were back to the ECRB to focus on the pending unresolved comments of the Ninth Avenue Wharf Terminal, the Gateway Park and the Clinton Basin boardwalks lining the basin on both sides. He explained that the project has begun grading outside of BCDC's jurisdiction to build the infrastructure for the future community at the site. The slide showed clearly the BCDC's legal boundaries excluding a parcel that was outside of the project between Clinton Basin and Lake Merritt Channel/Channel Park to the north of the project.

Mr. Fippin continued the overview side of the presentation noting that the wharf terminal would no longer sustain a grass park with a layer of soil over the open areas of the structure but instead would consist of tree planters and wood deck and chairs. All the areas shown with green on the site plans in the presentation that included grass would be on shore to make the distinction between the green spaces shown on the overwater structures. The wharf currently consists of a concrete and timber deck. The latter would be completely removed along with the timber piles cut off at the mudline. The warehouse shed would be demolished but a portion would remain in place where a new concrete deck would be cast along with new piles. As for the Clinton Basin wall, based on ECRB input from the prior meeting, there would not be a tie-back wall, but instead a gravity wall (concrete block or condensed fill block) would be erected.

His next slide indicated the amount of cut and fill in order for the Board to discern the amounts of Bay fill in relation to the removal of fill. The amounts based on the slide information were 211,619 and 41,120 sf of cut and fill, respectively.

Mr. Trivedi did now a presentation on sea level rise. He pointed out that the information was tied to the City of Oakland Datum primarily because it is a City of Oakland project, which happened to be to Mean Higher High Water (MHHW) corresponding to 6.21 and 6.44 feet in NAVD and MLLW datums, respectively. The minimum proposed elevation criteria for the project would be three feet above base flood elevation (BFE). Most places would exceed this minimum elevation. Wave run-up would not affect any of the structures, but the only place where wave run-up would affect it would be in the north-west region, the marsh area for Channel Island. The

BFE (100-year return period water level) for this location was 9.27 feet NAVD. He gave a brief description of the top elevation of each region with the wharf terminal being above 13.5 feet NAVD, Clinton Basin boardwalk and bulkhead at 12.3 feet NAVD. The streets and building finished floors were planned at 12.3 feet NAVD, six feet higher than BFE, which implied that adaptation may not be needed for such structures, and that only public access areas would be adapted to new elevations once the three feet exceedance of BFE had been reached. According to him, those areas that could be exposed in the future would have enough physical setback for a retreat strategy. That was the end of his presentation.

Mr. Fippin returned to lead the presentation adding that the design methodology and analysis was performed in accordance with criteria provided in publications commonly used for marine geotechnical projects such as the National Cooperative Highway Research Program or NCHRP Report 611 regarding the seismic analysis and design of retaining walls, buried structures, slopes and embankments, the ASCE 7-10, ASCE 61-14 on seismic design of piers and wharves, and the California Building Code (CBC) of 2013.

He showed the results of the ground motion hazard analysis, which comprised seven different time history earthquakes from around the world. The time history information of earthquake motions was compared in relation to the response spectra (spectral accelerations/g versus period/in seconds) consisting of a curve peaking acceleration at about 1 second. Based on the average curve of all the time histories, the results showed that using the California Building code spectrum would be conservative as it is higher than the average of the seven time histories. The CBC code spectrum, for both Site Class D and E would be used for the analysis. Different spectra would be used for different locations, depending on thickness of soft Young Bay Mud. He said that as per the guidelines of ASCE 61-14 a push-over analysis was done to simulate lateral load-deflection (springs) applied towards and away from the land and at sloping ground conditions to the different sections; different springs were developed for different soils and each type of pile. He indicated that the pinning forces of the piles were analyzed for their resistance to soil movement. This analysis was new since the previous meeting and takes the pinning forces of the piles in reinforcing the slope. The analysis estimates the deformation of the soils in order to determine the magnitude of resistance the pile is going to give to potential ground motion. The soils were pretty stable under static conditions but were prone to movement under seismic ground motion. A slope failure zone was mapped to analyze the pile displacement based on the NCHRP methodology. An iterative approach was done to combine the slope failure modes with the resistance (shear resistance) of the pinning forces of the piles. The analysis resulted in a displacement-based approach.

The summary of the slope stability analysis showed the comparison between three different methods of arriving at the slope deformations. NCHRP was selected as the middle value of movement for all sections of the wharf. Based on the analysis and the selection of the NCHRP displacement values that took into account the soil profiles of deep bay mud, two sections of the wharf were selected for retrofit of the piles, at sections D and B, to reduce anticipated movement. Mr. French ask why the bay mud was thickest at those locations. Mr. Fippin was not certain whether it was due to depositions of the historical marsh in the area.

In areas where the results of the estimated displacement were around 4 inches, it was determined that seismic retrofit of the piles was not necessary such as areas of sections A, C. Sections of wharf B and D would require retrofit since the deformation results were larger than 4 inches. The method for the retrofit followed the General Limit Equilibrium Method pursuant to NCHRP 611. The analysis involved the representation of the force as the combination of active and dynamic loads that the wall would experience during the design earthquake and amount of load the passive resistance of the soil and a wall, if necessary, would resist. The type of wall would be a combi wall at section D, consisting of a combination of king and sheet piles driven down to mudline to create a continuous wall. The goal at section D is to have less displacement since the surface section would support the retrofit shed for community or other purposes. At section B, sheet piles would be driven flush with the baymud. After an inquiry from Chair Borcherdt, Mr. Fippin said the sheet piles would be driven as close as possible to the estimated toe of the rock dike. He believed that the rock dike would not move significantly if the wall was placed in close proximity to it. The mass of the rock has been included in the analysis of the slope deformations. Further description and discussions on the role of the rock dike and on the geology of the site continued.

Mr. Fippin continued to describe the engineering approach of the Clinton Basin. The site was man-made and was dredged in to a marsh. Most of the soils are over consolidated. There has been some accretion happening since it was originally dredged in the 1940s. Based on the comments of the ECRB, the previous proposal of a tie-back wall had been revised to include instead a gravity wall structure. The benefits would translate into a safer structure without overturning issues, and this type of wall would prevent spill of fill into the Bay. The back side of the gravity wall will be backfilled with dredged material. The fill would be higher than original ground in the area in order to settle and self-consolidate. After two years, the fill would be surcharged to become stable. There would be less than six inches for lateral displacements. There would be limited risk of bulkhead collapse in larger than (earthquake) design event. Mr. French did some of his own estimates with the available information and asked whether non-circular failure surface mode had been looked at. Mr. Fippin replied that his team had not looked at it, but the suggestion was good feedback to look further into the design.

Later on, Mr. Fippin showed the summary of the results of the slope stability analysis at Clinton Basin showing a maximum displacement of six inches in the area of the middle of the channel, the site of the boardwalks. Precast/prestressed concrete piles would be furnished for the structures that would be able to accommodate the displacements. Dr. Gilpin asked about section C-C of the slide, which represented the furthest out area of the channel or the mouth of the channel, where the information indicated more substantial areas of historical accretion. Mr. Fippin replied that these areas would be dredged out and new engineered fill would be placed to meet the required slope stability of very low deformations.

Professor Moehle asked questions regarding the site response analysis and the reason for using the seven history motions. Mr. Fippin indicated that this analysis had been done pursuant to the Board's request last February. The team had selected the most conservative spectra for the analysis of slope deformations. The histories had been selected to match the Site Class D for the soils interactions. Prof. Moehle missed the previous discussions on this, but Mr. Fippin briefed him on the intent of the information. Further explanation and discussion of the analysis ensued. Mr. French opined that the engineering criteria seemed appropriate.

There were questions about the settlement report; however, it was found out that such report did not apply to the review as the areas of study were outside of BCDC's jurisdiction. Mr. French just asked the team to check out the information regarding the surcharge and the three feet of cellular concrete, which when submerged it could be buoyant.

Mr. Yao did the structural presentation of the shed structure over the Ninth Avenue Wharf. An assessment of the piles was done. He described the configuration of the piles consisting of timber piles on the land side and concrete piles in the centerline of the wharf. The latter and the former had been repaired previously with precast jackets. He described the conditions of the piles from serious to satisfactory as per the CBC/CAR (condition assessment rating). Concrete core testing was done on the pile jackets to assess the compressive strengths. The information would provide the capacity of the piles in order to compare with a design demand. As a back-up strategy, deteriorated piles critical to seismic performance will be restored to their original capacity and protected for durability for its design service life. The piles would be wrapped with fabric reinforced protection or FRP jackets. Inside the piles there would be a reinforced steel cage. However, based on the new findings there does not seem to be the need for these.

Mr. Yao described the rationale for the seismic performance of the Ninth Avenue Wharf. Based on a risk classification, the wharf would not be essential to the regional economy, would not be essential to post-earthquake recovery of the region; however, life safety protection was essential. Therefore, the seismic performance would be based on "life safety protection" only. After a major earthquake, the structure would be damaged to warrant a new structure, but it would prevent collapse (Level 2 Earthquake). This was a departure from the Moffatt & Nichol approach. The structure would continue to support gravity loads in the post-earthquake state and would not prevent egress from the site.

Mr. Yao explained that the design approach would follow displacement-based performance criteria per CBC 31F and ASCE 61-14. Displacement demand must be less than displacement capacity (D/C less than 1.0). A check was done on the capacity of the piles. The methodology included an inertial load and kinematic load analysis, inertial and kinematic load effects, design check of capacity-protected elements/actions and torsional load effect as per ASCE 61-14. The seismic assessment (Level 2 performance) would be based on either the CBC or the ASCE 61-14. Both check for concrete compression and reinforcing steel tension above and below ground. The team chose the more conservative of the two, which was the CBC Chapter 31F (MOTEMS). After some questioning form the Board, Mr. Yao said that this methodology would

allow them to compare a site-specific from a code-specific spectrum. The chair asked Mr. Yao not to get too much into the details but requested to know how the structure responded during the Loma Prieta (LP) earthquake. Mr. Yao said that while some existing piles seemed plumb, others were straight indicating a construction flaw rather than the outcome of an earthquake. Chair Borcherdt was concerned that the piles had lost some of their initial capacity from the effects of the last earthquakes, and the analysis had not addressed such loss.

In conclusion, Mr. Yao suggested that: (1) nonlinear static pushover analyses for inertial, kinematic and combination of both loads are completed; (2) pinning forces of piles along the sliding wedge of rock/soil are determined; (3) shears on pile are checked as capacity-protected actions; (4) toe walls are required in Section B-B' and Section D-D' in order to stabilize the slope and prevent shear failure of concrete piles; (5) the seismic retrofit design meets Level 2 seismic performance; and (6) deteriorated pile are to be strengthened and/or protected for durability.

Next, Mr. Kevin Treat did the terminal building retrofit. As a reminder, 80 percent of the structure would be removed, and only the 20 percent would be used for other events and community purposes. He described the structure as a truss moment frame (concrete wall and steel truss framing) and the use of ASCE 41 as the criteria. He worked in conjunction with the soils and structural engineer to assess the amount of movement of the deck to develop a satisfactory approach to the retrofit of the building. New plywood would be placed on the wall to resist shear movement. The roof overhang would be retrofitted to resist wind upload.

The next topic was regarding the seismic instrumentation of the project. Mr. Fippin showed a Google-Earth image of the existing ground motion stations in the area. To enhance the instrumentation program of the area, his team suggested two deck-mounted instruments (x-y- and z-direction accelerometers and biaxial tilt meters to monitor deck movement) at the Brooklyn Basin wharf and at one of the boardwalks on Clinton Basin. The team also discussed doing survey points on the ground along 9th Avenue and on the structures. The chair asked whether this strategy had been worked out with the CGS. Chair Borcherdt asked whether the Ninth Avenue wharf would be ahead of the Clinton Basin part of the project and what percent level design did the new information conform to. Mr. Fippin suggested a 50-percent design. The chair noted that seismic performance of the two walls would be crucial in the project. In that regard, it would be beneficial to the project proponents and the engineering community in general to instrument the areas of the sheet pilings under the community center building. Borehole sensors could be installed at the top of the alluvium soils, top of the bay muds to know the type of ground motions the retaining structure would experience. There was some back-and-forth conversation about the best location of the instruments. Mr. Fippin suggested locations closer to the shore. Chair Borcherdt suggested that the survey monuments should be located along profiles extending along and into areas subject to lateral spreading in order to measure potential movements before, during and after seismic events. Further discussion on this subject ensued. However, the chair made a strong recommendation to seek CGS's advice on this effort. Mr. VanNess indicated that additional stakeholders should be allowed to participate in this decision to make decisions of the instruments' best locations and with CGS about the program's maintenance.

As an additional note, Mr. Holmes noted the difficulties in understanding the one-way iterations and combination of the two effects (kinematic and inertial loads) to sum up a displacement. Mr. Yao suggested that without the time histories, it is a challenge trying to explain the approach. However, the analysis was allowed pursuant to the code.

As described, the project was at about a 50-percent criteria design. Chair Borcherdt asked BCDC whether it would like the Board to consider recommending the project to continue progress and draft project summaries. Further, he asked BCDC whether the Board would continue to be able to request additional project reviews. He then turned to the members of the Board seeking opinions of the project. Mr. Montes reminded the Board of an upcoming Board meeting on October 22, 2015 to consider if the Board required a follow-up. Chair Borcherdt indicated that the applicant could send a response to clarify this point ahead of the next meeting.

Based on all the information above a motion was drafted as described below:

ECRB Motion: Preamble with the understanding that:

The ECRB reviewed the engineering criteria for the Brooklyn Basin Ninth Avenue Wharf and Clinton Basin project on February 26 when the project was in an earlier design stage of less than 35 percent. The Applicant's consultants (ENGEO, Moffat and Nichol and Simpson Gumpertz & Heger) have provided additional information including:

a. Sheet pile questions and consideration of future dredging

b. Site-specific response spectra

c. Estimates of fill within the 100-foot shoreline band with respect to overwater structures

d. Estimates of Bay fill

e. Impact on the Bay from potential sheet pile wall failures

f. Active and passive strengths, dynamic seismic increments, and selection of methodology for sheet pile wall analysis.

g. Consideration of time of soil consolidation

h. Displacement of existing piles outward of the proposed toe wall piles

The following ECRB review comments are based on referenced information:

a. As described by the applicant and its representatives, since the kinematic demands seem to control over the transient dynamic response, the period may be increased relative to what the transient analysis had given. Therefore, the possibility exists that the period is naturally longer than what has been estimated because the kinematic movement could be causing increased damage. The applicant is encouraged to look at this detail.

b. As reported, the period was described to be as long as 0.9 seconds. Starting at 0.3 seconds, it elongates by a factor of three, suggesting softening/displacement is by a factor of 9, which seems to contradict the 1- to 2-inch displacement as reported. The applicant is encouraged to address this subject and agreed to run a check.

c. A request was made regarding a check on the non-circular failure surface under the gravity structure in Clinton Basin, and a check of the stability and stiffness/deformation of the very tall un-tied-back cantilever wall in Brooklyn Basin.

d. A seismic instrumentation plan was requested to be submitted at a later date, but not necessarily at the October 22, 2015 meeting. The applicant was encouraged to make the best effort to engage the engineering community in this effort and to provide some results even at a later date not yet identified.

Motion: Professor Moehle moved the motion.

Motion Second: Mr. Jim French.

The motion was approved unanimously with no abstentions.

6. **Adjournment.** There being no further old or new business, the meeting was adjourned at approximately 5:00 p.m.

Respectfully submitted,

RAFAEL MONTES, P.E.
Board Secretary

Approved, with minor corrections at the
Engineering Criteria Review Board Meeting of October 22, 2015.